ence of cardiac failure with auricular fibrillation, has an established place in our armamentarium. Ten drops of a standard tincture, given with an ordinary dropper three times a day, can have no conceivable value in such cases. The further use of the tincture for home administration is to be deplored, unless given in known dosage of a standard preparation until results have been achieved.

DISCUSSION

Dudley Fulton, M. D. (Pacific Mutual Building, Los Angeles)—The broad conception of heart failure and its treatment, as expressed by Kerr, represents the best clinical teaching. Certain points should be emphasized. There is no parallel between the pathology of the heart, as ascertained by physical examination, and its functions. While murmurs are important in the diagnosis of organic disease of the heart, they play a very minor role in prognosis, since the heart may maintain the circulation over prolonged periods with any one of its valves totally destroyed. The functions of the myocardium form the ground-work of the present knowledge of the heart. In one of the largest clinical groups, the cardiac disease associated with hypertension, nephritis and arteriosclerosis, the evidence is strong that the initial pathology arises elsewhere in the vascular tree than the myocardium, probably in the smallest arterioles, the cardiac and the renal changes being secondary processes. The term "circulatory failure" in this group is more accurate than "heart failure."

This conception broadens therapy to the adoption of measures conducive to the maintenance of the circulation as a whole rather than to stimulation of the heart.

Emphasis should be given another important principle enunciated by Kerr. While we can never repay our debt to the stethoscope and electrocardiagraph, their employment having given us interesting and valuable academic details concerning the functions of the heart, we must admit, however, that it is bed-side study and observation that gives us the practicable information as to how sick our cardiac patient is, and what should be done for him. Instrumentation has been overdone in that the examination of the patient himself is neglected.

Of first importance are the subjective symptoms of the patient. They present the earliest and most dependable evidences of a failing circulation. This includes the proper interpretation of dyspnoea and precordial distress, following anything which increases the heart beat, such as exertion, meals, and mental excitement. A consideration of edema of the liver and extremities, lessened urine output, cyanosis and pallor clearly outvalues the timing of a murmur. It is interesting that disturbed cardiac rhythm offers the best indications for drug treatment. While digitalis is always indicated in broken compensation of the heart, its effects are usually disappointing except in auricular fibrillation and sometimes auricular flutter.

We disapprove, however, the use of the very large doses of digitalis recently advised, except by the cardiac expert, in the disturbances mentioned above. McKenzie considers that digitalis is as sharply limited in diseases of the heart as quinine is in fevers.

The same criticism, in our opinion, applies to quinidine. Its use in general practice should be deferred until its precise indication and dosage are better determined than at present. Disaster has followed its use in a sufficiently large number of reported cases to justify this conservatism.

Dr. Kerr (closing)—I am very glad to have the opinion of Dr. Fulton on the points which I brought out. His wide experience in internal medicine makes these opinions extremely valuable.

THE ESSENTIAL POINTS IN THE TREATMENT OF DIABETES WITH INSULIN *

By W. D. SANSUM, M. D., and
N. R. BLATHERWICK, Ph. D.
(From the Potter Metabolic Clinic of the Santa Barbara Cottage Hospital, Santa Barbara, Calif.)

The work of Banting and Best and their associates in the isolation and clinical use of the sugar-metabolizing hormone, insulin, and its specificity in the treatment of diabetes is now well known and accepted. There remains the general problem of further perfecting the methods of its use.

Since the advent of insulin, 250 diabetic patients have been admitted to this clinic. Of these, 150 have been severe enough to warrant the use of insulin. It is beyond the scope of this paper, which is intended to outline methods of treatment only, to present the clinical data at hand. The clinical results from the first 100 cases have been carefully summarized and will appear at an early date in the Journal of Metabolic Research.

In the treatment of diabetes there are three objects to be attained:

1. The patient should be kept continuously "sugar free," and the blood sugar should be normal.

2. The patient should be kept continuously free from acidosis.

3. The patient should be nourished as evidenced by a satisfactory weight.

These conditions may be fulfilled, in many instances, by careful dietary procedures, although when a patient's tolerance is very low, continuous bed-rest is necessary to avoid a serious loss of weight. If the disease becomes progressively worse, as it usually does in severe and untreated cases, a stage is finally reached when the patient can no longer be kept free from sugar and acidosis, even if the most careful attention is paid to the diet and the patient is kept continuously in bed.

Many patients wait too long before beginning careful, dietetic management, and specialists in the treatment of this disease are, therefore, not given a fair chance to do the best work. Dr. Joslin has collected the statistics, showing the advantages of careful treatment. Between the years 1814 and 1914 the death rate from diabetes in patients who were treated in the best hospitals was 28 per 100 per year. The year 1914 marked a significant advance in the dietary treatment. The principles outlined in the first paragraph were carefully adhered to. In patients so treated the death rate has fallen to 4 per 100 per year.

By the use of insulin, the death rate from diabetes may be reduced to zero if the patients are seen before deep coma has developed, and patients who would otherwise remain chronic invalids may be restored to health by ample diets in proportion as this specific extract becomes available. At the present cost it is not available to all. It is not a cure for diabetes. Patients will need to exercise greater care than ever with their diets, but since these diets will be ample for their needs, they will be fully repaid for the additional efforts.

* Presented to the Section on Medicine, San Francisco, June, 1923.

In the treatment of diabetes with insulin there are four conditions that should be satisfied:

1. The sugar-burning or utilizing power of the insulin, in grams per cubic centimeter, should be known.

2. The patient's natural tolerance should be determined in grams of sugar-formers.

3. The exact value in sugar-formers of the proposed diet should be known.

4. The dosage of insulin may then be adjusted to make up the difference between the sugar-formers of the proposed diet and those of the patient's natural tolerance.

The sugar-formers of the diet designated by "G," Woodyatt, are 100 per cent of the carbohydrate, 58 per cent of the protein, and 10 per cent of the fat. It has long been known that all starches are changed into sugar during the process of digestion. When the protein molecule is digested it is split into proteoses, peptones, and eventually into amnio acids. Some of the amnio acids may be changed into sugar, while others may be changed into fatty bodies. The neutral fats are the glycerolesters of fatty acids. Glycerine is a sugar-former. The reduction of food values and tolerances to the common denominator sugar-formers very materially simplifies the calculations.

1. The sugar-burning power or utilizing power of the insulin should be accurately known. Eli Lilly's iletin is evaluated in rabbit units. In our experience, their present unit is worth a little less than 1 gram of sugar-metabolizing power. Their H-20 product, which indicates 20 rabbit units in each cc., has a sugar-metabolizing power of 17 grams.

2. The patient's tolerance may be determined by diet alone or by diet plus insulin. When diet alone is used, the patient is desugarized by partial starvation. When sugar-free, diet additions are gradually made. A diet is eventually found upon which the patient can remain continuously free from sugar in the urine and with a normal blood sugar. Suppose such a diet contains 35 grams of carbohydrate, 38 grams of protein, and 83 grams of fat. The sugar-formers of such a diet are 100 per cent of 35, plus 58 per cent of 38, plus 10 per cent of 83; or 35 plus 22.04, plus 8.3, or 65.34 grams. We would say that such a patient has a natural tolerance of 65 grams of sugar-formers.

In the terminal stages of diabetes, patients do not endure starvation well, both because of the existing acidosis and their already marked emaciated conditions. Many of them cannot be desugarized by any dietary procedure, since their natural tolerances are too low to permit of even bed-rest maintenance diets. In such cases, tolerances may be determined by diet plus insulin. If the acidosis is not too severe, a patient may be given a bed-rest, maintenance diet similar to the above which contains a little more than 1000 calories, with 65 grams of sugar-formers. Small doses of insulin are given at first. The insulin is gradually increased until the patient is continuously free from sugar. Suppose that it requires 60 grams of assistance, in the form of insulin, to carry the above diet, the patient's natural tolerance would then be 65 less 60, or 5 grams of sugar-formers.

If the patient has a severe acidosis, no attempt is made to measure the patient until the acidosis is controlled. We control the acidosis by giving the patient a diet rich in carbohydrate, low in protein, and as free as possible from fat, such as an oatmeal, skimmed milk, orange juice diet, using comparatively large doses of insulin, which, as it metabolizes the carbohydrate, will in turn metabolize the fat, and thus dissipate the acidosis.

3. The exact value of the proposed diet should be known. We consider 80 to 100 grams of protein as ample for the needs of an adult. In adjusting the fat we have followed the formula of Woodyatt's optimal diets, never letting the fat actually oxidized exceed two times the carbohydrate plus one-half the protein. Following this plan, a diet "G" of 65 will carry approximately a 1000 calorie diet, and a diet "G" of 120 will carry a 2000 calorie diet.

4. The adjustment of the dose. Suppose that the natural tolerance of a patient, as determined either by diet or by diet plus insulin, is found to be 65. Suppose that the proposed diet contains 133 grams of sugar-formers. The patient will need 133, less 65 or 68 grams of assistance; 68 divided by 17 will then equal the number of cc. of the Lilly iletin required, or 4 cc. In our experience, we have found that in the majority of patients, with an equal distribution of food between the three meals of the day, that 5/8 of the total dose should be given before breakfast and 3/8 before supper. In this instance, we would give 2.5 cc. before breakfast and 1.5 cc. before supper.

THE SYMPTOMS AND TREATMENT OF THE OVERDOSAGE WITH INSULIN

When a rabbit is given an excessive dose of insulin the blood sugar rapidly falls. When it reaches about .04 per cent, convulsions occur, which are promptly relieved by the administration of glucose.

Patients may also become too sugar free from an overdosage with insulin. This may occur from unfamiliarity with the drug. It occurred with us more frequently in the past when the strength of the insulin was not standardized as well as it is now, especially, as with improved methods of preparation, we were making more potent extracts. It may occur if a patient's tolerance is unknown, and if his diet is not carefully estimated, when it would be impossible to properly adjust the dose, even if the value of the insulin were accurately known. Overdosage with insulin excusably occurs in the first few weeks of treatment when, by keeping the patient continuously free from acidosis and urinary sugar, his tolerance usually grows very rapidly. Under these conditions, the symptoms of overdosage are usually mild and easily treated if the patient is taught to recognize them early.

THE SYMPTOMS OF OVERDOSAGE

1. Hunger—As a patient's blood sugar falls, he usually experiences a keen appetite. This is not a very reliable symptom, because nearly all diabetic patients are notably hungry.

2. Slow Mentality—A patient complains that

he cannot think well or concentrate on any one thing.

3. Extreme Weakness—This is probably the most reliable early symptom. When a patient is metabolizing an ample net diet, he should feel well and strong, but as he is overdosed with insulin a feeling of weakness comes on. Sometimes patients describe this as a dizzy feeling.

4. Rapid Pulse and Respiration—The pulse is usually weak and the respiration rapid.

5. Visual Disturbances—The patient complains of an inability to read, due to double vision or the blurring of the print. He cannot see to write well. The eyes may ache and dark spots may appear before them.

6. "Shaky Feeling"—The word "shaky," or "The Shakes," are terms that have been coined by patients to describe this sensation and, though not particularly scientific, describe the condition very well. The patient simply shakes all over. He is not cold, nor are these symptoms associated with or followed by appreciable elevations of body temperature. We believe that this symptom is nature's method of causing the glycogen which has been stored in the liver and muscles to be changed into glucose and poured into the blood stream.

7. Sweating—The "shaky" feeling is always followed by a profuse sweat. This must be watched for, especially in new patients, since it is a very reliable symptom.

8. Unconsciousness—If a patient has been too seriously overdosed he may become unconscious, falling into a deep sleep from which it is impossible to rouse him until sugar has been administered. At this stage he cannot be forced to swallow fluids.

9. Convulsions—If the overdose has been still greater, convulsions may occur. Fortunately, these are very rarely seen in patients, but are a common occurrence in the rabbits. In our experimental evaluation of insulin we have used thousands of rabbits, and in thousands of them such convulsions have been produced, but despite such marked overdosage, only a few have died in the entire series. The intravenous administration of 5 cc. of a 20 per cent solution of glucose restores such convulsed rabbits in two or three minutes.

THE TREATMENT OF THE OVERDOSAGE WITH INSULIN

The treatment of the overdosage with insulin is undoubtedly started by nature as she changes the glycogen stores into sugar and pours them into the blood stream. In this clinic, whenever a patient experiences the slightest symptoms of being too sugar-free, 20 grams of milk chocolate, having a food value of carbohydrate 10, protein 2, and fat 7, are given at once, followed by or dissolved in hot water. No attempt is made to determine whether the urine or blood is too free from sugar, for we much prefer to give this emergency ration many times when it is not needed rather than to omit it once when it is needed. The milder symptoms, such as hunger, are promptly relieved by serving the tray a little early. The patient in the early stages of treatment is instructed never to leave the hospital without the emergency, chocolate ration. Many other substances containing sugar-formers could be used and are used in lieu of the chocolate. In the beginning we used white crackers, but the starch must be changed into sugar before it can be absorbed. Later we used whole milk, but half-pints of whole milk do not stay sweet any appreciable length of time and are difficult for the patient to carry around with him. Orange juice, when available, is an excellent form of a rapidly assimilable carbohydrate. Adrenalin may be administered hypodermically, which causes the body to rapidly change large quantities of glycogen into sugar. In our experience, the milk chocolate, especially when followed by or dissolved in hot water, has proven to be an excellent form of medication. It is also very acceptable to the diabetic patient who, for so many years, has been without candy. Patients often welcome too sugar-free symptoms because of the chocolate candy reward, and oftentimes nibble away at the chocolate to make it last as long as possible, when they should eat it as rapidly as possible.

If a patient cannot swallow, glucose should be given by vein at once. We keep on the hospital floors a number of ounce bottles of sterilized 50 per cent glucose and a 25 cc. syringe sterilized for instant use, although we are rarely obliged to use this type of medication. We have had no fatalities from an overdosage with insulin.

DISCUSSION

Samuel H. Hurwitz, M. D. (516 Sutter Street, San Francisco)—The great value and the specificity of insulin in the treatment of diabetes mellitus has already been conclusively proved. Now that the use of this extract is to become more general among the practitioners of medicine it is very important to acquaint them with its indications, method of use, and symptoms of overdosage. This has been well accomplished by Dr. Sansum's simple and straightforward paper. It is particularly gratifying that he has emphasized the importance of dietary treatment in connection with insulin and the fact that we shall need to exercise even greater care with our diets than heretofore, so as to establish in each individual patient a balance between dietary needs and insulin dosage. Where this is carefully done there need be little fear of the symptoms of overdosage which Dr. Sansum has given so vividly.

In this connection I should like to correct the impression which it appears exists among some physicians that the use of insulin will do away entirely with the necessity for moderate undernutrition. The fundamental principles upon which low caloric diets have been used in treating diabetes still remain. These diets will still continue to serve as a very useful method of resting pancreatic function and of thereby improving the patient's tolerance. But the extreme grades of undernutrition necessary in severe cases in pre-insulin days need no longer be resorted to where insulin is available. It has been the practice in our clinic to give patients a diet which, although adequate to regain health and strength and to maintain normal activity, was nevertheless a little lower rather than a little higher calorically. We have felt that it was wiser to err on the side of lower rather than higher diets. This has not been easy to do at all times because we have had, in the first instance, to yield to the patient's cry for more food, and secondly, because of the widespread misinformation existing among patients that, with insulin available, they could partake of many glucose-forming foods which had been denied them heretofore. Although this is true to a limited extent, we have had to

emphasize to these patients on numerous occasions that they were paying too dearly for the whistle, and that an additional slice of bread or one-half of a cantaloupe was not worth the price of the insulin used to burn them with. Besides, this would violate the principle of rest as applied to pancreatic function.

The sugar-burning power of insulin, Lilly has not been found by us to be a constant one. In some of our severe diabetics the glucose-utilizing power of one unit of insulin was found to be less than one gram of glucose; whereas, in some milder cases, one unit of insulin was found to be the equivalent of five or more grams of glucose.

W. D. Sansum (closing) — We are very pleased that Dr. Hurwitz has emphasized so strongly the importance of exact dietary procedures.

We are attempting to restore all patients as rapidly as possible to a normal weight, because, when fully nourished, patients require somewhat less food for the same activities than do the undernourished ones. A layer of normal, subcutaneous fat appears to be an appreciable asset in the conserving of body heat.

In our experience the present iletin unit is not as strong as was the original unit. When the unit was defined as the amount of iletin necessary to produce a convulsion in a one-kilogram rabbit, we found this unit worth approximately 1.25 grams of sugar-metabolizing power. With the new definition of the unit as one-third of the iletin necessary to produce a convulsion in a previously starved, two-kilogram rabbit, we have found the value of the unit in the neighborhood of .85 grams.

Our experience has been different from that of Dr. Hurwitz, in that the sugar-metabolizing power of the unit has not varied appreciably in patients of different degrees of severity. We have also found no appreciable variation with age and weight or with low and high diets. We believe that the comparatively high values given by some workers to the iletin unit in the milder cases should have been credited to growths in natural tolerance, for in a number of such instances we have re-measured patients dietetically and found growths in tolerance sufficient to convince us of the constancy of the sugar-metabolizing power of the unit in a given lot number.

Household Nursing Association—In another column we print an article outlining the work of the Household Nursing Association of Boston. This institution has not attracted the attention of either the public or the profession which it rightly deserves. It has not sought publicity but has quietly perfected its organization and raised its standards while it has been supplying a type of economical and efficient home nursing care for patients of moderate means.

The demand for such nursing has been recently receiving more attention from important medical sources but it should be a matter of local pride that public spirited citizens and physicians of Boston have anticipated this demand and to the extent of their ability have been supplying it for the last ten years. The highly trained graduate nurse has become a necessity but is often a problem as well. The old-fashioned attendant nurse is often a far more difficult problem but sometimes a necessary substitute. Supervised attendant nurses of good character and trained by a standard curriculum in the simple household duties of caring for the sick will go far toward solving these problems and will soon we believe take their place as necessary adjuncts to the efficient and kindly care of patients of moderate means. We urge our readers to become acquainted with this association's work and give it their support.—Editorial Boston Medical and Surgical Journal, May 10, 1923.

THE ETIOLOGY OF GASTRIC AND DUODENAL ULCERS*

By GEORGE E. EBRIGHT, M. D.,
University of California Medical School

It is evident upon reviewing clinical experiences and the literature upon the causation of gastric and duodenal ulcer that the etiology of these conditions cannot be reduced to a very simple formula. A varied number of conditions may induce ulceration of the stomach. It occurs in association with traumatism, diseases of the central nervous system, renal and cardiac diseases, anæmias, burns; but particularly since Virchow in 1855 emphasized the probability of vascular conditions playing a role in the production of ulcer, has attention been directed to embolism and thrombosis, particularly of bacterial origin. In 1857 Lebert injected pus into the venous circulation and produced acute gastric ulceration. Twenty-two years ago Letulle caused gastric ulceration by injecting guinea pigs with streptococci from puerperal sepsis. Clinical experiments for several years past have led observers to notice the association of an acute gastric ulcer with the occurrence of various acute infections, especially tonsillitis and aveolar abscesses. The important work of Billings upon focal infections has directed attention to probably the most common cause of not only the occurrence of ulceration, but especially the continued recurrence of the lesion. Rosenow's extensive studies have led him to the conclusion that "streptococci attaining a certain grade of virulence show a selective affinity for the gastric mucus surface." The expression of this view has led to considerable controversy. Moody, after experiments upon rabbits, opposes Rosenow's theory of selective affinity, and found that streptococci from aveolar abscesses produced lesions more frequently elsewhere in the body than in the gastroduodenal mucosa. Alanson Weeks is emphatic in his opinion based upon work with war risk insurance cases, that chronic gastric ulcers do not heal until focal infections are cleared up, particularly tonsils and teeth. E. J. Best, in charge of the Gastrointestinal Clinic of the University of California, leans to the same conclusion.

Very considerable experimentation has been directed toward the establishment of a relation between nerve influences and gastric ulceration, and particularly suggestive is that of Gundelfinger, who, after a series of ingenious experiments of vagus irritation, vagotomy, coeliac ganglion irritation, excision of coeliac ganglion, and combinations of these operations, arrives at two conclusions—first, that neither vagus irritation nor vagotomy causes gastric or duodenal ulceration in the dog, but, on the other hand, that coeliac ganglion irritation or extirpation caused erosion or ulceration in a hundred per cent of his cases. Doege expresses the opinion that psychic influence is a very prominent factor, and recalls a case where an individual dated the beginning of his ulcer from a period of highly excited state of emotionalism after an especially full meal. When one remembers the work of Pavlov upon the effect of emotional states on

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